

WATER SYSTEM DESIGN

Technical Design Manual #1



Chandler + Arizona

January 2002

TECHNICAL DESIGN MANUAL NO. 1

WATER SYSTEM DESIGN

TABLE OF CONTENTS

SECTION

- 1.0 POLICY
- 2.0 DEFINITIONS
- 3.0 ENGINEERING REQUIREMENTS
 - 3.1 Standard Specifications and Details
 - 3.2 Construction Materials
 - 3.3 Water Line Sizes
 - 3.4 Water Line Locations 3-2
 - 3.5 Valve Locations
 - 3.6 Water Line Design Requirements
 - 3.7 Private Water Line Design Requirements
 - 3.8 Fire Hydrants
 - 3.9 Domestic and Fire Service Policy for Multi-Family and Commercial Projects
 - 3.9.1 Commercial Installations
 - 3.9.1.1 Fire Lines
 - 3.9.1.2 Domestic Water Service Option No. 1
 - 3.9.1.3 Domestic Water Service Option No. 2
 - 3.9.2 Multi-Family Installations
 - 3.9.2.1 Fire Line and Domestic Service Option No. 1
 - 3.9.2.2 Fire Line and Domestic Service Option No. 2
 - 3.10 Irrigation Ditch and Tile Requirements
 - 3.11 Miscellaneous Requirements
- 4.0 PLAN REQUIREMENTS

SECTION 1.0 POLICY

The City Engineer reserves the right to modify the requirements of this manual when conditions warrant it.

Water lines shall border on each development to be served with municipal water. The developer is required to install all of the water lines, service lines, valves, fittings, and appurtenances within and adjacent to his development as determined necessary by the City Engineer. Water lines are required adjacent to all public streets.

A water system infrastructure analysis shall be required for proposed developments determined by the City Engineer to have a large impact on the water system. The developer of the property shall be responsible for all costs associated with the infrastructure analysis.

Under special conditions the City will accept a water line on private property. All of the following conditions must be met:

- 1) The water line must be fully integrated with the public water system and the water line must be tied into the public system at each end.
- 2) The water line must be in a dedicated easement.
- 3) The water line must meet City construction standards.
- 4) The City Engineer must determine that acceptance of the water line benefits the City.

SECTION 2.0 DEFINITIONS

Appurtenance: Item attached to a main structure to enable it to function, but not considered an integral part of it.

Developer: Any person(s), corporation, partnership, or firm desiring municipal water service.

Distribution System: The network of public water lines 16 inches in diameter and smaller which compose the basic grid and distribution system for Municipal water service.

Fire Line: A private water line located on private property which is utilized exclusively for providing water to fixed fire protection systems.

Municipal Water Service: Water service provided for domestic, commercial, recreational, and landscaping purposes.

Private Water Line: Any water line not owned and maintained by the City.

Public Water Line or Public Water Main: A water line owned and maintained by the City.

Reclaimed Water: Effluent which has been treated to achieve a quality suitable for its intended use as prescribed by Federal and State regulations.

Service Line: A pipe carrying water from the public water line to a water meter or other point of distribution.

Transmission Main: A public water line larger than 16 inches in diameter.

SECTION 3.0 ENGINEERING REQUIREMENTS

3.1 STANDARD SPECIFICATIONS AND DETAILS

All standard specifications and details for water system design are located in the City of Chandler Standard Specifications and Details manual.

3.2 CONSTRUCTION MATERIALS

All water lines located within the City of Chandler shall be polyvinyl chloride (PVC) per AWWA C-900 and C-905. C-900 pipe shall be rated for a minimum working pressure of a 150 psi, C-905 pipe shall be rated for a minimum working pressure of 235 psi, concrete pressure pipe (CCP), prestressed concrete cylinder pipe (PCCP), or ductile iron pipe (DIP) per AWWA C-151 with a 350 pressure class. CCP pipe may be used for water lines 16 inches to 42 inches in diameter, and PCCP may be used for water lines 42 inches in diameter and larger per MAG Standard Specification 758. Any pipe less than 36" in diameter, whether longitudinal or transverse to the street, located under pavement in an arterial, collector, local, or private street, shall be DIP. All DIP shall be installed with polywrap per AWWA C-600 and AWWA C-105. Asbestos-cement pipe (ACP) is not allowed.

DIP shall be installed through dip sections; including transitions to normal depth and through 1st section beyond. DIP shall be used for water line protection when MAG Standard Detail 404 is specified on the plans. All pipe in the ground shall have, AWG THWN #10 insulated copper tracing wire attached to the bottom of the pipe and interconnected to valves at valve box spacing intervals. Warning tape is to be used buried a minimum 12" above the pipe. Polyethylene encasement shall conform with the applicable requirements of AWWA C-600, C-105.

3.3 WATER LINE SIZES

All lines shall be sized in accordance with the current City Water Master Plan and the City water line size requirements listed below.

- 1) A 16-inch diameter water line is required along all section line streets. The City Engineer may require the installation of dual parallel 12-inch diameter water lines instead of the single 16-inch water line noted above when special conditions justify it. Dual parallel 12-inch diameter water lines are normally required adjacent to transmission mains, one on each side, or one tier of lots off of the section line street.
- 2) A 12-inch diameter water line is required at all one-half section line locations.
- 3) An 8-inch diameter water line is required at all one-quarter section line locations.

- 4) 8-inch diameter water lines are generally required in all commercial, industrial, and multi-family residential areas and shall be private unless otherwise directed by the City Engineer. The water lines must also be fully looped with intersecting water lines.
- 5) All other water lines shall be a minimum of 6 inches in diameter and fully looped with intersecting water lines, except as noted below.
- 6) A minimum 8-inch diameter water line is required for a dead end line longer than 300 feet or where the length of water line, between intersecting water lines, is greater than 1200 feet.
- 7) Each dead end line shall be looped where its length exceed 650 feet.
- 8) In the case of a phased development, each successive phase must satisfy all of the requirements listed above irrespective of the future phases.

3.4 WATER LINE LOCATIONS

The standard location for 16-inch and smaller water lines is 1 foot behind the sidewalk, 7 feet behind the back of curb on arterial streets, on the north and east sides of the street. When two water lines are installed adjacent to a street, the standard locations are one on each side of the street with the location determined as above. See City of Chandler Standard Details C-200, C-201, and C-202.

Transmission mains are normally installed under the pavement in the center of a traffic lane. This is graphically shown in the City of Chandler Standard Details C-200 and C-201. All public water lines shall be placed in either the public right-of-way or within a dedicated easement. The minimum easement width is 12 feet, with the entire easement free of property lines, boundary walls, and other obstructions for its entire length and width. Water lines, service lines, and fire lines are not allowed in retention basins. This does not apply to irrigation lines downstream of a backflow preventor. Water lines must be stubbed to adjacent undeveloped properties and sized in accordance with the Master Plan.

Water lines are required adjacent to half streets when the east or north one-half is being constructed or, when in the opinion of the City Engineer, special conditions justify the construction of the water line.

3.5 VALVE LOCATIONS

All tees require three valves, and four valves are normally required on all crosses. Fire hydrant tees require only one valve, unless the fire hydrant installation is also serving as a stub-out. Additional isolation valves are required at approximately 600-foot intervals or when pipe runs longer than 800 feet are encountered. All stub-outs shall be provided with sufficient valving to permit the extension of the water line without interrupting any

water services. Valves on transmission mains are required only at the section line and one-half section line points where a bypass valve assembly is required.

Provisions shall be made to tie the transmission main into the distribution system at the section line and the one-half section line points with sufficient valving to completely isolate the transmission main from the distribution system without obstructing the functional characteristics of either the transmission main or the distribution system. Valves at intersections must be located at the first lot line away from the intersection and must be stationed. A bypass valve assembly is required wherever a transmission main comes to a dead-end with a curb stop. No valves shall be located in the sidewalk or ramped areas.

The grade of a valve box and cover located outside of a paved area shall be 1 to 2 inches above sidewalk or adjacent grade. Valve box installations shall conform to City of Chandler Standard Detail C-307 and C-318. In areas subject to wheel loading, valve box installations shall also conform to City of Chandler Standard Detail C-317.

For all extensions of water lines over eleven months in age, a new valve of like size shall be installed in the new line at the point of extension. A 3/4-inch saddle and riser shall be installed in the line between the new valve and the first existing valve in the existing system. This line will be flushed and tested by the City and the 3/4-inch nut and riser removed. After the City accepts the new water system, and the new valve and existing valves are turned on, the operating nut shall be removed from one of the valves, leaving only one valve operable.

Valve installations must comply with the following requirements:

- 1) Distribution line (16-inch diameter and smaller), spacing no greater than 600 feet.
- 2) Distribution line, three valves on each tee and four valves on each cross.
- 3) Distribution line must be located on property lines, where appropriate.
- 4) Transmission main, (if greater than 16-inch diameter), spacing no greater than one-half mile.
- 5) Valve box installations must conform to City of Chandler Standard Detail C-318, C-307, and C-317 in areas subject to wheel loads. These details shall be specified in the construction notes on the plan.
- 6) Valves at intersections must be located at the first lot line away from the intersection and must be stationed. If no lot line exists, valve is to be located minimum of 6 feet from curb return.
- 7) Valves at tee intersections must be located laterally along the top of the tee to the first lot line clear of the intersection to avoid conflict with sidewalk

ramps and must be stationed. Valves on the leg of the tee must be located per item 6 above.

- 8) Refer to valve blocking per MAG Standard Detail 301.
- 9) No valve shall be located in sidewalk, curb, or ramp areas. Exceptions require a variance from the City Engineer.
- 10) Valve locations must be stationed.

3.6 WATER LINE DESIGN REQUIREMENTS

All water line designs shall meet the following requirements:

- 1) Back-flow prevention devices are required on the potable water services to:
 - a) Chemical manufacturing plants.
 - b) Hospitals.
 - c) Mortuaries.
 - d) Plating plants.
 - e) Premises with auxiliary water supply or distribution systems.
 - f) Reclaimed water users.
 - g) Sewage treatment plants.
 - h) Irrigation systems.
 - i) Any other sites individually designated by the City's Water Supervisor.
- 2) A 1-inch water service, with stationing, is required to all single-family lots. Landscape tracts must be approved with services of a size as determined by a landscape architect and must be shown on the Civil plans.
- 3) Water stub-outs must be provided for all adjacent undeveloped property, unless otherwise justified. Water stub-outs must also be provided for all major parcels within, or adjacent to, the development.
- 4) Ductile iron pipe (mechanical joint or restrained) shall be installed through all dip sections, including transitions to normal depth. All dip sections must be shown in profile view and must include the following items:
 - a) Minimum vertical clearance of 2 feet from obstructions.
 - b) Encasement per MAG Standard Detail 404, if applicable.
 - c) Thrust blocks or joint restraint with standard detail call-out.
- 5) Wherever possible, dead-end lines will be extended beyond paved surfaces to avoid pavement cutting at time of future connection and be equipped with a curb stop per C.O.C. Standard Detail C-300.

3.7 PRIVATE WATER LINE DESIGN REQUIREMENTS

Private water lines are not allowed within the right-of-way or utility easements.

Per City Code, all water lines 3 inches in diameter and larger are deemed to be off-site improvements. Therefore, private water lines 3 inches in diameter and larger are subject to all of the requirements listed in this manual and are not governed by the Uniform Plumbing Code. All private water lines less than 3 inches in diameter are governed by the Uniform Plumbing Code.

For completeness, the requirements given in the Uniform Plumbing Code shall apply to all situations not specifically covered by this manual.

3.8 FIRE HYDRANTS

Fire hydrant installations must comply with the following requirements.

- 1) 450 feet maximum spacing in single family residential areas.
- 2) 300 feet maximum spacing in other developed areas.
- 3) 1,000 feet maximum spacing in undeveloped areas.
- 4) One fire hydrant must be installed at all subdivision entrances.
- 5) Fire hydrant installations must conform to City of Chandler Standard Detail C-303, C-304, and C-305.
- 6) Fire hydrants must be stationed.
- 7) Fire hydrant installations at intersections shall be per Standard Detail C-305.
- 8) On cluster developments, a fire hydrant must be located no farther than 250 feet from each structure, measured along a hose-laying line to the farthest corner of the structure.

The City Engineer and the Fire Marshall reserve the right to modify the spacing requirements listed above.

Hydrants shall be equipped with locking caps. Hydrants out of service shall have collars with "out-of-service" signs until the hydrant is put into service. The signs shall comply with Fire Department Standard Detail FD123 and shall remain on the fire hydrants until the water lines are tested, approved, and pressurized. The signs shall be reinstalled at any time any fire hydrants are taken out of service, regardless of reason or the amount of time the fire hydrants are expected to be out of service, and dispatch shall be notified at 480-782-4130. Only off-site personnel shall remove a sign.

Water service that is supplied by only two 6-inch water lines shall have a maximum of six hydrants. One fire hydrant must be installed at each subdivision entrance.

If a model home area is to be part of a development, then a fire hydrant shall be provided at or near the site entrance. The hydrant shall be located within 75 feet of the access roadway and within 300 feet of the property line of the most remote lot to be built upon. The hydrant shall be connected to an approved water source. If the distance to the water source is more than 400 feet, the system must be looped to an additional source.

All cul-de-sac dead-end lines must have a fire hydrant installed at the end of line. The fire hydrant shall be located 6 feet from the back of curb and the valve shall be located in the pavement 1 foot from the lip of the gutter. All lines longer than 650 feet shall be looped.

Fire hydrants shall be furnished by the Contractor and installed in accordance with City of Chandler Standard Details C-303 and C-304. All fire hydrants shall be painted according to Fire Department Standards after installation.

3.9 DOMESTIC AND FIRE SERVICE POLICY FOR MULTI-FAMILY AND COMMERCIAL PROJECTS

3.9.1 Commercial Installations

3.9.1.1 Fire Lines

A private fire service main serving private fire hydrants (red) and water base fire protection system (sprinkler system) with double or single feed as required. Connections to the public water supply shall be with a fire line detector check valve, MAG Standard Detail 346 with fire department connection (FDC) per City of Chandler Fire Department Standard Detail FD101.

City of Chandler Fire Department Standard Detail FD102 or FD103 is required when hazardous materials, and Group H occupancy is involved with no on-site fire hydrants.

A Double Check Detector Assembly is required when there are on-site private fire hydrants and hazardous materials, and Group H occupancy is involved.

Where a fire service main is serving only water-based fire protection systems with no on-site private fire hydrants, a swing check valve may be allowed in the connection to the public water supply per FD101.

3.9.1.2 Domestic Water Service Option No. 1

Service to individual units from a water main on the frontage of the project with individual meters located in the public right-of-way. Three inch service and under per City of Chandler Standard Detail No. C-311; and three inch service or larger per City of Chandler Standard Detail No. C-315. Vault installations per City of Chandler Standard Detail No. C-313.

3.9.1.3 Domestic Water Service Option No. 2

A private water main with single or double feed providing services to the individual units. Connection to the public water supply shall be with master meters located in the public right-of-way and Double Check Valve Back-flow Prevention Assemblies, per above referenced City of Chandler details based on the required size.

3.9.2 Multi-Family Installations

3.9.2.1 Fire Line and Domestic Service Option No. 1

A private water main serving private fire hydrants (yellow with black top) only, with a double or single feed as required. Connections to the public water supply shall be with Double Detector Check Valve Back-flow Prevention Assemblies. The Double Detector Check Valve Back-flow Prevention Assemblies must be U.S.C. approved and installed per City of Chandler Standard Detail No. C-312 or C-314.

A private water main with a single or double feed providing domestic service and service to building fire protection systems (sprinkler systems) with no hydrants. Connection to the public water supply shall be with master meters and Double Check Valve Backflow Prevention Assemblies, per City of Chandler Standard Detail No. C-312 or C-314. Individual building fire protection lines must be installed to each building per NFPA 13R and D, with FDC located on building within 150 feet of a fire hydrant.

Office/recreation building fire protection systems (sprinkler systems) shall be per NFPA 13. The fire line shall be installed per Fire Department Detail No. FD101 with FDC within 150 feet of fire hydrant.

3.9.2.2 Fire Line and Domestic Service Option No. 2

A private water main serving private fire hydrants (yellow with black top), building fire protection systems (sprinkler systems) and domestic service with a single or double feed as required. Connection to the public water supply shall be with master meters located in the public right-of-way and Double Check Valve Backflow Prevention Assemblies, per City of Chandler Standard Detail No. C-312 or C-314. Individual building fire protection lines must be installed to each building per NFPA 13R and D, with FDC located on building within 150 feet of a fire hydrant.

Office/recreation building fire protection systems (sprinkler systems) shall be per NFPA 13. Fire line shall be installed per Fire Department Detail No. FD101 with FDC within 150 feet of fire hydrant.

Note: 1) Hydraulic calculations will be required in most instances to verify fire flows and residual pressures to both the fire hydrants and the fire sprinkler systems. Per NFPA 24, no private fire service main shall be smaller than 6-inches unless the following requirements are met:

- a) The main supplies only automatic sprinkler systems, open sprinkler systems, water spray fixed systems, foam systems, or Class II standpipe systems.
 - b) Sealed hydraulic calculations show that the main will supply the total demand at the appropriate pressure.
 - c) Main size shall be at least as large as the riser.
- 2) Normally a looped system is required on private water mains and private fire service mains per the City of Chandler Fire Department Guidelines. Maximum fire line lengths shall not exceed the following:
 - a) 6-inch diameter dead end lines shall not exceed 300 feet in length.
 - b) 8-inch diameter dead end lines shall not exceed 1,200 feet in length.
 - c) 6-inch looped lines shall not exceed 1,200 feet in total length.
- 3) All backflow prevention assemblies shall be on the current list of approved backflow prevention assemblies published by the "Foundation for Cross Connection Control and Hydraulic Research", University of California (USC). In addition, fire protection assemblies shall be UL listed or FM approved for fire protection use.
- 4) Backflow prevention assemblies are to be located immediately downstream of the line setter and the City water meter, per City of Chandler Standard Details C-312 and C-314. Any variance shall be requested through the City of Chandler Water Quality Department (480-782-3731).
- 5) Private hydrants connected to a fire protection system, i.e., those that will be pressurized through a fire department connection, shall be painted red.

3.10 IRRIGATION DITCH AND TILE REQUIREMENTS

All open irrigation ditches or canals, on or adjacent to properties to be developed, shall be undergrounded with irrigation pipe or shall be abandoned.

All irrigation pipe installed under roadways, driveways, or other pavement subject to vehicular traffic shall be designed to withstand H20 wheel loading. Pipe which runs parallel to the street shall be rubber gasket reinforced concrete (RGRCP). Pipe which crosses the right-of-way shall be rubber gasket reinforced concrete (RGRCP), or in cases where PVC is used up to the right-of-way line, the crossing may be constructed of C-900 PVC pipe or approved equal and the crossing shall be sleeved with C-900 or approved equal.

3.11 MISCELLANEOUS REQUIREMENTS

Water services may not be installed on 16-inch water lines unless approved by the City Engineer. Water services, fire hydrants, and fire lines shall not be installed on transmission mains. Water service lines shall be a minimum of 1 inch in diameter and shall not be located in driveways, washes, or retention/detention areas. Commercial and industrial facilities shall have a 6 inch minimum diameter water line stub-out opposite of the major commercial water line as to minimize street cuts. Meter boxes shall not be located in driveways and sidewalks.

Metallic, detectable warning tape shall be required for all plastic pipe. The tape shall be placed one foot above the top of pipe (maximum depth 4 feet) and shall be shown on as-built plans.

All calculations of water demand for a property shall include fire flows in accordance with the Uniform Fire Code Appendix III-A.

Water lines are required adjacent to half streets when the east or north one-half is being constructed or, when in the opinion of the City Engineer, special conditions justify the construction of the water line.

Resilient wedge gate valves are used on water lines 24 inches in diameter and smaller per MAG Standard Specification 630.3, unless otherwise noted. Butterfly valves are used on water lines 30 inches in diameter and larger with the operating nut installed on the side of the water line away from the monument line. City water valves shall be operated by City personnel only.

The cover material for water lines shall conform with MAG specifications. The depth of cover for water lines less than 12 inches in diameter shall be a minimum of 36 inches. Water lines 12 inches in diameter or greater shall have a minimum cover of 48 inches.

Dead-end lines shall be extended beyond paved surfaces to avoid pavement cutting at time of future connection and equipped with a curb stop per City of Chandler Standard Detail C-300.

The minimum separation between sewer and water lines shall be 6 feet horizontally and 2 feet vertically.

All abandoned water lines shall be removed and disposed of in a proper manner.

SECTION 4.0 PLAN REQUIREMENTS

All off-site construction plans shall be prepared and signed by a professional engineer who is qualified and registered by the State of Arizona to practice in the particular field of competency required by the type of improvements.

Plans shall be submitted on 24" x 36" sheets. The plans shall be drawn to an engineering scale with 1" = 20' and 1" = 40' being the preferred horizontal scales. The vertical scale, when profile is required, need not differ from the horizontal scale by a precise factor of 10. Water, sewer, and paving plans may all be shown on the same plan sheets if a horizontal scale no smaller than 1" = 20' is used.

All water lines and transmission mains 12 inches or larger in diameter shall be shown in both plan and profile views. Twelve inch diameter water lines shall be shown in both plan and profile views whenever existing utilities are likely to be encountered. All dip sections shall be shown in both plan and profile views regardless of the water line size.

The engineer shall obtain a copy of the latest Water Notes and Water Plan Review Checklist from the Development Services Department.

The following requirements apply to all water line plans:

- 1) The name of the proposed development must be shown on the cover sheet.
- 2) The developer's name, address, and phone number must be shown on the cover sheet.
- 3) The engineer's name, address, and phone number must be shown on the cover sheet.
- 4) A vicinity or site location map is needed on the cover sheet.
- 5) An index map with the following information is needed on the cover sheet:
 - a) Existing water system including fire hydrants and valves.
 - b) Proposed water system including fire hydrants and valves.
 - c) Pipe sizes.
 - d) Sheet numbers.
 - e) City limit lines where applicable.
 - f) Existing water system with fire hydrants on perimeter.
 - g) Phase limits and numbers if applicable.

6) The following approval block shall be on the cover sheet:

a) For Capital Improvement Projects:

APPROVED:

DIRECTOR OF PUBLIC WORKS

DATE

CITY ENGINEER

DATE

b) For all other projects:

APPROVED FOR COMPLIANCE WITH CITY CODE:

CITY ENGINEER

DATE

PUBLIC WORKS

DATE

7) The following approval block, with County signature, shall be on the cover sheet:

DOMESTIC WATER APPROVED:

MARICOPA COUNTY

DATE

ENVIRONMENTAL SERVICES DEPARTMENT

8) The following current City standard notes must be shown on the cover sheet:

a) General notes.

b) Water notes.

9) Plans must be coordinated with all of the appropriate utility companies on the list below. A "utility coordination block" shall be shown on the cover sheet indicating the names of the utility companies and the date plans were submitted to them.

Salt River Project (Power)
Salt River Project (SRVWUA)
Arizona Public Service
U.S. West Communications
COX Cable
Southwest Gas

El Paso Natural Gas
Southern Pacific Gas
Sprint Telephone Long Distance
AT&T Telephone Long Distance
Air Products and Chemicals, Inc.

- 10) All elevations shown on the plans must be referenced to an approved City benchmark. The City's Benchmark ID Number (CMCN#) and verbatim description must match the latest edition of "City of Chandler Vertical Control Base List", and must be shown on the cover sheet.
- 11) If the development is adjacent to a current City Project/Improvement District, plans must be coordinated with the City Project/Improvement District Engineer. The following approval block (with signature) shall be shown on the cover sheet.

APPROVED FOR COORDINATION

DATE

PROJECT: _____

- 12) If a portion of the improvements shown on the plans are within the jurisdiction of the State/County, acquire the appropriate permit. Indicate the permit number on the cover sheet.
- 13) Provide a quantity tabulation on the cover sheet; see the Certificate of Quantities list for the required items.
- 14) A service tap detail is required on the cover sheet showing the following items:
 - a) Standard tap location.
 - b) Minimum 6-foot separation between water and sewer taps.
 - c) Standard detail number.
 - d) Backflow prevention device location with standard detail number.
- 15) If PVC pipe material is used the plans shall include the bedding detail on the cover sheet and the following note shall be shown on the plans:

PVC water lines shall be installed per City of Chandler Standard Detail C-402 and City of Chandler Standard Spec. No. 10.
- 16) The following shall be shown on the lower right of the cover sheet over the title block:

C. O. C. Log No. _____

- 17) When applicable, the following note must be shown on the cover sheet:

"THE FOLLOWING INSTALLATION PROCEDURE SHALL BE FOLLOWED ON ALL EXTENSIONS OF WATER LINES OVER ELEVEN (11) MONTHS IN AGE:

A new valve of like size shall be installed in the new line at the point of extension. A 3/4-inch saddle and riser shall be installed in the line between the new valve and the first existing valve in the existing system. This line will be flushed and tested by the City and the 3/4-inch nut and riser removed.

After the new water system is accepted by the City, and the new valve and existing valve are turned on, the operating nut shall be removed from one or the other of the valves and leaving only one valve operable."

- 18) The minimum height of all text and lettering shall be 0.1-inch (one-tenth of one inch).
- 19) North arrows must be shown on each sheet.
- 20) The scale must be shown on each sheet.
- 21) Match lines and sheet references must be shown on each sheet and stations, if applicable.
- 22) Phase limits and numbers must be shown on all applicable sheets.
- 23) All existing water lines being tied into and nearest fire hydrants must be shown.
- 24) Dimensional ties must be provided for all existing water lines being tied into. This requirement is usually satisfied by providing both a station number and a dimensional tie to the street centerline.
- 25) All proposed water lines must be shown. Water lines are required adjacent to all streets.
- 26) Water lines must be dimensioned from the street centerline.
- 27) Show all existing and proposed reclaimed water lines on the plans.
- 28) All crossings of existing or proposed utility lines must be shown in both plan and profile views. This includes water and sewer. Telephone, electric, and any other buried utility lines must also be shown if known. This

requirement can be satisfied if the crossings are shown on separate sewer profile sheets.